

On the breeding biology of Yellowish Flycatcher *Empidonax flavescens* in Costa Rica

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SUMMARY.—I report data on the breeding biology of Yellowish Flycatcher *Empidonax flavescens* from the highlands of central Costa Rica. Nesting coincided with the early part of the rainy season. Nests were cup-shaped and constructed of fine grasses, while the outer part was a bulky structure mainly built from mosses. Clutch size was 2–3 eggs and incubation period was 16–17 days. The birds had at least two broods per season and, in some cases, perhaps three broods. The nestling period lasted 15–16 days. Nesting success was very high (81%) which is unusual for a small passerine that constructs an open cup nest.

Yellowish Flycatcher *Empidonax flavescens* is a small tyrannid that is widespread in subtropical and temperate zones from southern Mexico to western Panama (AOU 1998). In Costa Rica it is a common resident on both slopes at c.600–2,400 m (Stiles & Skutch 1989), and in the centre of the country the species is found particularly around edges, open woodland and along rivers. Although some notes on its behaviour and breeding biology, based on one nest in Guatemala and three nests in Costa Rica, were reported by Skutch (1967), nothing has been published concerning incubation and growth rates. Large quantities of data are available concerning growth rate patterns for many temperate species, but limited comparative data are available for tropical taxa (Ricklefs 1968, Starck & Ricklefs 1998). Here I report data on growth rates and additional data on the species' breeding biology from observations made in central Costa Rica.

Study site and Methods

Data for this study were gathered in Costa Rica, in the río Tiribí area, prov. San José (1,900–2,100 m) at 09°57'N 83°55'W. Observations were made primarily in the river canyon, but also in adjacent areas. The site was described in detail by Marín & Stiles (1992) and it was visited in June–August 1995 and May–August 1996–97, with additional observations in June–August 1984–85 and February–September 1986. Visits were made to nests during the incubation and nestling periods at 1–5-day intervals. Body mass was recorded using AVINET spring balances (± 0.1 g) of 10 and or 30 g capacity, depending on nestling age. Culmen length was taken to the nearest 0.1 mm using dial calipers, and wing length (flattened) and tail length using a standard wing rule, following the techniques described by Baldwin *et al.* (1931). All measurements were recorded prior to 12.00 h. To facilitate individual recognition, nestlings were initially marked using coloured thread and then banded with a numbered plastic band.

Egg measurements (Table 1) are based on museum specimens deposited at the Western Foundation of Vertebrate Zoology (WVZ) and field measurements from the study area. Eggs were measured to the nearest 0.01 mm using digital calipers. Mean egg mass was calculated from museum specimens at WVZ, using the formula ($M=k.L.B^2$), where L = length, B = breadth and k was calculated by regression using fresh egg mass (Hoyt 1979). Egg shapes follow Preston (*in* Palmer 1962). The incubation period was taken from the laying of the first egg to the hatching of the first egg. The hatching date is recorded age zero on

TABLE 1

Dimensions and mass of Yellowish Flycatcher *Empidonax flavescens* eggs (n=25).

Parameter	Mean	SD	Range
Length (mm)	17.84	0.766	16.48–19.39
Width (mm)	13.91	0.362	13.20–14.78
Mass ^a (g)	1.93	—	1.7–2.1 ^b

^a Calculated from mean egg measurements; see Methods.

^b Calculated mass from the smallest and largest egg.

the graphs. Adult measurements and body mass were taken from mist-netted birds and specimens at WFVZ, all from the study area. The time for nestlings to grow 10–90% of their body mass (the $T_{(10-90)}$ period; Case 1978) and the growth rate constant *K* (Ricklefs 1976) were determined using methods outlined by these authors.

Results and Discussion

Breeding seasonality.—The rainy season in central Costa Rica starts in April and ends in December, with two rainfall peaks, in May–June and in September–October, and less wet periods in June and August (Marín & Stiles 1992). Nests were found from mid April to mid July, with most being documented in May–June (83%; *n*=18) during the early wet season. Post mid July, between the peaks of the rainy season, the species was not observed at the study site. Although Skutch (1967) indicated that the season started not earlier than March (he reported fledged young by late April), within the study area the earliest recorded date for fresh eggs was 14 April. The breeding season in the study area coincided with Skutch’s (1950) general findings in Costa Rica that at high altitudes nests are concentrated in April–June. Skutch (1950) indicated that food is most abundant during this period, which coincides also with the main breeding season in the country for many other bird species.

Although individual females were not marked, evidence suggests that this flycatcher may produce more than two broods per season. At most nests, after fledging of the first brood, a second nest was constructed in close proximity, adjacent or atop the old nest, and on three occasions a third nest was built post fledging of the second brood.

Nest, eggs and incubation.—The nest was well described by Skutch (1967) as ‘bulky masses of green moss, or of mosses and liverworts, interlaced with a few fibrous rootlets, horsehair, or similar binding materials.’ All of the observed nests were cup-shaped and built of mosses and liverworts, and the cup was lined with very fine and soft dry grasses (Fig. 1A–B). All nests observed or collected (*n*=27) were constructed on embankments, 24 over running water and three on road embankments. For ten nests the height above the water or ground level was 1.0–3.2 m (mean 1.9 m).

Eggs were creamy white with reddish-brown blotches and spots mostly towards the larger end. Most had a well-defined wreath and some were ‘capped’ (Fig. 1B). Clutch size was 2–3 eggs. Of 27 nests from field or museum specimens, ten clutches comprised two eggs and 17 had three eggs. For four nests Skutch (1967) found that three nests had three eggs and one nest two eggs. Shape ranged mainly from short-subelliptical (69%) to subelliptical (27%) but some were oval (4%) (*n*=26). For measurements see Table 1. Incubation period at four nests was 16–17 days, which is longer than in more temperate congeners (Fitzpatrick 2004). Of 21 eggs from nine nests followed in more detail, 17 nestlings (81%) fledged successfully, three failed to hatch and one nestling was found dead at an early age. This

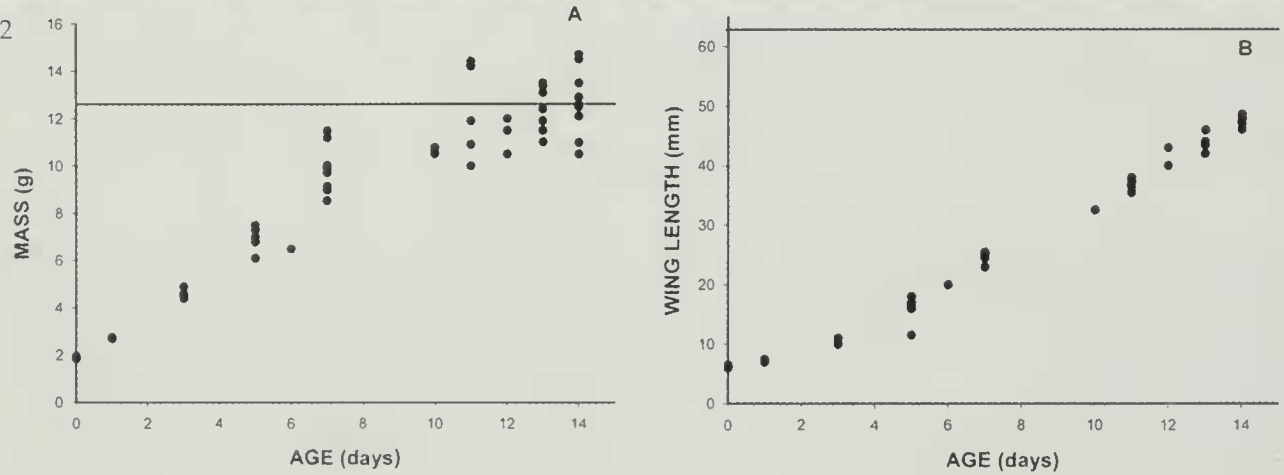


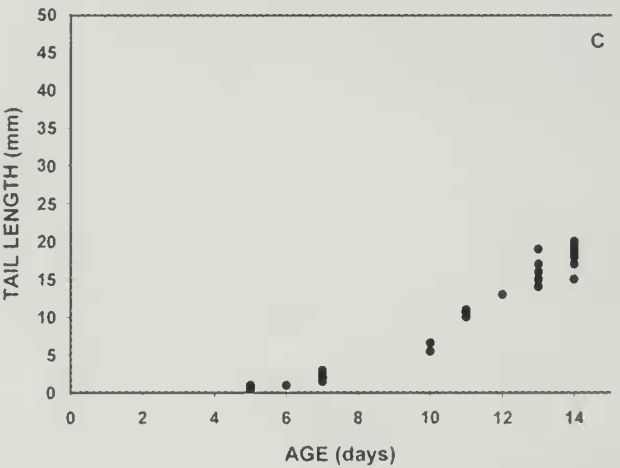
Figure 1A. Adult Yellowish Flycatcher *Empidonax flavescens* on the nest, and (B) nest and eggs of Yellowish Flycatcher (Manuel Marín)

Figure 2A–C. Growth curves for three parameters from 18 nestlings of Yellowish Flycatcher *Empidonax flavescens* in Costa Rica. The solid horizontal line represents the mean size of adults (see text).

rate of productivity is relatively high for a small tropical passerine that builds an open-cup nest (Skutch 1976).

Nestling development.—I followed the full development of seven nestlings, from three nests, from hatching through fledgling and 11 nestlings from four nests, with partial data ranging from one to four measurements per nestling. The nestlings hatched almost completely naked, with a few buff-coloured down feathers on the back and head. The body was yellowish orange, with the gape flanges bright yellow and the gape yellowish orange. The bill was yellowish with a grey tone to the tip and the claws were orange-yellow.

Hatching mass was 1.9 g (15% of adult size; adult mass [sexes combined] was 12.6 g \pm 0.47; $n=4$). Maximum mass in nestlings was reached just prior to fledging. The maximum mass reached by nestlings from a brood size of two was 14.7 g (116% of adult size) but in a brood of three was 13.5 g (107% adult size), i.e. 8.1% difference (Fig 2A). The overall T_{10-90} was 9.7 days and K was 0.453. I have no comparable data from the tropics, but in Pacific-slope Flycatcher *Empidonax difficilis*, a temperate breeding species with a larger clutch size (up to five eggs) and of similar mass (9–12 g) these values are 10.1 days and $K=0.436$ (Ricklefs 1968, Fitzpatrick 2004), i.e. slightly slower than Yellowish Flycatcher. The larger



(15 g) Willow Flycatcher *E. traillii* has a faster growth with values of 9.3 days and $K=0.472$ (Ricklefs 1968). No clear pattern to its development exists because (a) Yellowish Flycatcher contrasts with the general trend that tropical birds develop slower than temperate species, but (b) it is in accordance with overall trends that smaller species develop faster (Ricklefs 1968, 1983).

Maximum wing length prior to fledging was 48.5 mm, 77% of adult size (63.2 mm \pm 2.36; $n=7$; Fig. 2B) and the tail reached a maximum of 20 mm, 40.1% adult size (49.8 mm \pm 1.86; $n=7$) (Fig. 2C). Tarsus length by age 11 days was adult size (16.2 mm \pm 0.69; $n=7$) and culmen length reached a max. 74.5% of adult size at fledging (adult size 10.2 mm \pm 0.11; $n=7$).

The eyes were closed on hatching and about half-open by days 5–6. By age 5–7 days buffy down was dominant on the head and back, and pin feathers on the wings were close to bare sheath. On days 5–6 the yellowish feathers on the chest and body-sides were ready to sprout and they broke sheath on days 7–8. By age 9–10 days the rectrices had broken sheath. By days 11–12 the young were very active and were apt to jump from the nest when approached. Nestlings fledged at age 15–16 days, but in one nest Skutch (1967) found that the nestlings remained 17 days.

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